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Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION  
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In the Matter of )  
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Amendment of Parts 2, 21, and 94 ) RM-8004  
of the Commission's Rules to )  
Accommodate Common Carrier )  
and Private Op-Fixed Microwave )  
Systems in Bands Above 3 GHz )

To: The Commission

ORIGINAL  
FILE

COMMENTS OF SPATIAL COMMUNICATIONS, INC.

Spatial Communications, Inc. ("SCI") hereby comments on the above-captioned petition for rulemaking of Alcatel Network Systems, Inc. ("Alcatel").<sup>1/</sup> Alcatel filed its petition in response to a Commission proposals to allocate 220 MHz of spectrum in the 1.85 - 2.2 GHz band for new telecommunications services, including Personal Communications Services ("PCS").<sup>2/</sup> Alcatel supports in principle the Commission's spectrum allocation proposals in the Emerging Technologies rulemaking.<sup>3/</sup> Alcatel maintains, however, that the Commission should suspend proceedings in the Emerging Technologies rulemaking until new

<sup>1/</sup> See Amendment of Parts 2, 21, and 94 of the Commission's Rules to Accommodate Common Carrier and Private-Op Fixed Microwave Systems in Bands Above 3 GHz, RM-7981, FCC Public Notice No. DA-92-705 (rel. June 2, 1992) ("Alcatel petition").

<sup>2/</sup> See Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, 7 FCC Rcd 1542 (1992) ("Emerging Technologies rulemaking"). In addition to PCS, the Commission identifies "generic" mobile satellite service, low-Earth orbit satellite service, and digital audio broadcasting as candidates for accommodation in the new 2 GHz allocations.

<sup>3/</sup> Alcatel Petition at 14.

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rules for the operation of private microwave systems in alternative bands are adopted in a separate proceeding. As discussed more fully below, SCI supports efforts to ensure the ongoing availability of spectrum for services provided by 2 GHz microwave operators. Contrary to the assertions of Alcatel, however, there is no need to delay the Emerging Technologies rulemaking and related ongoing allocation proceedings, or to initiate separate proceedings to achieve the goals set forth in the Alcatel petition.<sup>4/</sup>

#### Background

SCI was formed to develop and commercialize a full range of personal communications service ("PCS") technologies utilizing Spatial-Division Multiple Access ("SDMA"), a revolutionary spectral management technology developed by principals of SCI.<sup>5/</sup>

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<sup>4/</sup> The Utilities Telecommunications Council ("UTC") has filed a similar petition for rulemaking requesting initiation of separate proceedings to establish technical rules to facilitate relocation of 2 GHz Fixed microwave systems. See Amendment of Parts 2, 21, and 94 of the Commission's Rules to Accommodate Private Microwave Systems in the 1.71-1.85 GHz Band and in Bands Above 3 GHz, RM-7981, FCC Public Notice, Mimeo No. 22934 (rel. May 1, 1992). SCI maintains that the concerns addressed in the UTC petition can be readily addressed in the Emerging Technologies rulemaking. See Reply Comments of Spatial Communications, Inc., RM-7981 (filed June 23, 1992).

<sup>5/</sup> See Request of Spatial Communications, Inc. for a Pioneer's Preference in the PCS Licensing Process, (Gen. Docket No. 90-314), File No. PP-73, (filed May 4, 1992) ("SCI PCS Pioneer's Preference Request").

SDMA combines phased array antenna technology, state-of-the-art digital signal processing equipment, and proprietary signal processing software to make possible for the first time dynamic exploitation of the spatial dimension in the channel assignment process of mobile communications systems. SDMA is a "front end" technology that is fully compatible with systems using all current spectrum access techniques (i.e., Frequency-Division Multiple Access, Time-Division Multiple Access, and Code-Division Multiple Access).

An SDMA-equipped mobile communications system locates and tracks on a real-time basis each active user in its service area.<sup>6/</sup> The SDMA system utilizes this information to generate concentrated "pencil beam" transmissions. These transmissions actually follow a user's movements, while reducing co-channel base station emissions in other directions, using a technique SCI refers to as "dynamic spatial nulling". SDMA's dynamic spatial nulling capability results in a decrease in power radiated in unwanted directions by as much as 30 dB lower than the signal strength emitted by conventional omnidirectional or sectoral base station antennas.

SDMA-equipped systems use the same tracking information to focus the desired signal reception capabilities of a base station's phased antenna array. The resulting improvements in

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<sup>6/</sup> The ability to provide extremely precise position determination-related services is a bi-product of an SDMA-equipped system's user location and tracking capability.

base station receiving capabilities facilitate decreases of 12-18 dB in the required output power of user terminals, while requiring no modification of existing handset designs. Additionally, by using the same dynamic spatial nulling techniques employed in the transmit direction, an SDMA-equipped system is capable of reducing by as much as 30 dB base station receiver susceptibility to co-channel interference from unwanted emitters.

The ability of SDMA technology to generate very narrow transmission and reception paths that follow movements of users and to employ dynamic spatial nulling techniques allows SDMA-equipped systems to increase a mobile communications system's useable channel capacity by as much as a factor of ten. Because SDMA is a "front end" technology, the resulting increases in capacity add to the efficiencies afforded by use of Frequency-Division Multiple Access, Time-Division Multiple Access, and Code-Division Multiple Access. SDMA will also afford significant improvements in signal quality, and reduce system implementation costs.

Another major benefit that will accrue from implementation of SCI's SDMA technology is the dramatic enhancement of prospects for long-term co-primary sharing between new services and incumbent 2 GHz point-to-point microwave services. The capacity increases afforded by SDMA will expand substantially (i.e., by as much as a factor of ten) the available spectrum for new 2 GHz

services. Additionally, as discussed more fully below, SDMA's capability to spatially direct transmissions, and to spatially detect transmission from other sources (e.g., microwave systems) will allow SDMA-equipped PCS systems to operate on a co-channel basis with microwave systems using separation distances much smaller than those required by systems not using SDMA.

### Argument

Alcatel asserts that the Emerging Technologies rulemaking should be suspended pending the completion of a separate proceeding to adopt rules governing the possible relocation of 2 GHz microwave operations.<sup>7/</sup> Alcatel contends that the Commission's proposal<sup>8/</sup> to forego the establishment of technical rules and instead issue relocated microwave operators blanket waivers of existing technical rules for microwave operations in bands above 3 GHz is ill-advised.<sup>9/</sup>

SCI agrees that blanket waivers of existing technical rules for 4, 6, and 11 GHz microwave operations may not be the most effective way of facilitating the eventual relocation of 2 GHz microwave operations. SCI strongly disagrees, however, with Alcatel's contention that a separate proceeding to develop rules

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<sup>7/</sup> Alcatel petition at 14.

<sup>8/</sup> Emerging Technologies NPRM at para. 20.

<sup>9/</sup> Alcatel petition at 17.

for relocated 2 GHz microwave operations must be completed before further Commission action in the Emerging Technologies rulemaking.

The Emerging Technologies NPRM envisions a ten to fifteen year period for the migration of 2 GHz microwave users.<sup>10/</sup> The extended period over which relocation might occur, in combination with the mitigating forces of technological advances, such as SDMA, negates any possible arguments for suspending the Emerging Technologies rulemaking.

In the initial years of implementing new 2 GHz services, the capacity increases afforded through the use of SDMA technology could alleviate the need for new systems to operate on a co-channel basis in close geographic proximity to Fixed Service systems. When the growth of traffic makes geographically proximate co-channel operations necessary, SDMA technology will substantially reduce the required separation distances between co-channel facilities in different services. Specifically, terrestrial systems using SDMA will be able to locate base stations closer to co-channel microwave facilities by a factor of 22-25 over base stations not equipped with SDMA. The separation distance from co-channel Fixed Service systems for user terminals (e.g., PCS handsets) served by SDMA-equipped systems will be

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<sup>10/</sup> Emerging Technologies NPRM at para. 24.

reduced by a factor of 4-6 over user terminals operating in conjunction with non-SDMA equipped systems.<sup>11/</sup>

In an effort to explore the solutions that technologies such as SDMA may provide with regards to sharing in the 2 GHz band between microwave systems and new services, SCI has initiated informal discussions with principal 2 GHz microwave operators. These meetings have resulted in interest on the part of all parties involved to establish an "Ad Hoc" industry committee to explore technical and procedural solutions to co-primary sharing of the 2 GHz band between microwave users and new telecommunications services. SCI believes that industry cooperation will help alleviate the concerns that resulted in the filing of the Alcatel petition.

#### Conclusion

SCI is in full agreement with Alcatel with regards to the need to ensure the ongoing availability of spectrum for services provided by 2 GHz microwave operators. When applied to systems operating in the 2 GHz band, the interservice interference avoidance aspects of technologies such as SDMA can extend the timetable or possibly eliminate the need for relocation of 2 GHz microwave operations. Because of the long transition period and

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<sup>11/</sup> Fixed Service microwave systems can also be equipped with SDMA to further reduce potential interference from new 2 GHz services. The cost of equipping microwave systems with SDMA could possibly be borne by the operators of new 2 GHz services.

the mitigating forces of technological developments, migration of microwave users to alternative bands, if even necessary, is not likely to be required for a number of years after initial implementation of new 2 GHz services. For the above-stated reasons, there is no need to delay the Emerging Technologies rulemaking or initiate separate proceedings to achieve the goals set forth in the Alcatel petition. Accordingly, SCI requests that the Commission address the concerns of incumbent 2 GHz users within the context of the Emerging Technologies rulemaking, and related proceedings to establish allocations for new telecommunications services.

Respectfully submitted,

SPATIAL COMMUNICATIONS, INC.

By:

  
Walter H. Sonnenfeldt

Walter Sonnenfeldt &  
Associates  
1600 Wilson Boulevard  
Suite 500  
Arlington, Virginia 22209  
(703) 276-1800, ext 258

Its Attorney

J. Daniel Bariault  
President

1011 Fourth Avenue Plaza  
Suite 3200  
Seattle, Washington 98154  
(206) 447-9205

July 2, 1992



**CERTIFICATE OF SERVICE**

I, Walter H. Sonnenfeldt, hereby certify that copies of the foregoing "Comments of Spatial Communications, Inc." were sent this 2nd day of July, 1992, by first-class United States mail, postage prepaid to:

Robert J. Miller  
Gardere & Wynne, LLP  
1601 Elm Street  
Suite 3000  
Dallas, Texas 75201

Counsel for Alcatel Network Systems, Inc.

  
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Walter H. Sonnenfeldt